

REMARKS

In view of the above amendments and the following remarks, reconsideration of the rejections contained in the Office Action of July 5, 2007 is respectfully requested.

By this Amendment, claims 1-4 and 6-9 have been amended, claim 5 has been cancelled and new claims 10-12 have been added. Thus, claims 1-4 and 6-12 are currently pending in the application. No new matter has been added by these amendments.

The entire specification has been reviewed and revised. Due to the number of revisions, the amendments to the specification have been incorporated into the attached substitute specification. For the Examiner's benefit, a marked-up copy of the specification indicating the changes made thereto is also enclosed. No new matter has been added by the revisions. Entry of the substitute specification is thus respectfully requested.

On page 2 of the Office Action, the Examiner objected to claims 2 and 7-9 for containing informalities. In particular, the Examiner identified limitations in claims 2, 7 and 8 which lacked proper antecedent basis. In order to address these objections, claims 2, 7 and 8 have been amended so as to provide proper antecedent basis for the identified limitations. Therefore, it is respectfully submitted that the Examiner's objections are not applicable to the amended claims.

On pages 2-3 of the Office Action, the Examiner rejected claim 6 under 35 U.S.C. § 112, second paragraph, as being indefinite. In particular, the Examiner asserted that the phrase "the additional weight unit" lacks antecedent basis. In order to address this rejection, claim 6 has been amended to recite "the auxiliary weight unit," which is a feature that is recited in amended independent claim 1. Accordingly, it is respectfully submitted that the phrase "the auxiliary weight unit" has proper antecedent basis, and therefore that the Examiner's formal rejection under § 112 is not applicable to amended claim 6.

In item 6 on pages 3-5 of the Office Action, the Examiner rejected claims 1-9 under 35 U.S.C. § 103(a) as being unpatentable over Ouchi et al. (WO 03/052350) in view of Mori (US 6,477,897) or Tomikawa (JP 08-166244) or Hasegawa et al. (JP 2000-292172), and further in view of Yachi et al. (US 5,996,410), and further in view of Takahashi (US 4,498,025) or Ganter et al. (US 3,697,766) or Staudte (US 3,683,213). For the reasons discussed below, it is respectfully submitted that the amended claims are clearly patentable over the prior art of record.

Amended independent claim 1 recites an angular velocity sensor comprising a tuning fork vibrator which includes a first vibrating arm having a first end and a second end, with the first vibrating arm having a fundamental vibration frequency, a second vibrating arm having a first end and a second end, with the second vibrating arm having the fundamental vibration frequency, and a coupling portion for coupling the first end of the first vibrating arm to the first end of the second vibrating arm. The angular velocity sensor of claim 1 also comprises a drive unit for causing the first vibrating arm to vibrate, with the drive unit having a driving resistance and being provided on the first vibrating arm. Claim 1 also recites a detection unit for detecting an amount of deflection of one of the first vibrating arm and the second vibrating arm, with the detection unit being provided on the one of the first vibrating arm and the second vibrating arm.

The angular velocity sensor of claim 1 also comprises *an auxiliary weight unit provided on the first vibrating arm and between the drive unit and the second end of the first vibrating arm, with the auxiliary weight unit being separated from the drive unit and the detection unit.* Claim 1 also recites that *the auxiliary weight unit includes a first electrode provided on the first vibrating arm, a piezoelectric layer provided on the first electrode, and a second electrode provided on the piezoelectric layer.*

Amended independent claim 7 recites a method for designing an angular velocity sensor which includes a tuning fork vibrator having a first vibrating arm and a second vibrating arm, a drive unit provided on the first vibrating arm, a detection unit provided on one of the first vibrating arm and the second vibrating arm, and *an auxiliary weight unit provided on the first vibrating arm and between the drive unit and the second end of the first vibrating arm, with the auxiliary weight unit being separated from the drive unit and the detection unit,* and with the auxiliary weight unit including a first electrode provided on the first vibrating arm, a piezoelectric layer provided on the first electrode, and a second electrode provided on the piezoelectric layer. Claim 7 also recites that the method includes determining a size of the first vibrating arm, and determining a size of the drive unit so that a ratio $R1/R2$ is smaller than “1”, where $R1$ is the driving resistance at the fundamental vibration frequency, and $R2$ is the driving resistance at a frequency different from the fundamental vibration frequency.

Ouchi discloses a thin-film resonator which, as shown in Fig. 1, includes arms 2, 3. The

arm 2 includes first electrode 10 and second electrode 11, first piezoelectric film 14 and second piezoelectric film 15 on the first and second electrodes 10 and 11, respectively, and third and fourth electrodes 18 and 19 on the first and second piezoelectric films 14 and 15, respectively. The arm 3 includes a similar set of electrodes, and the resonator vibrates by a voltage being applied to the various electrodes. As shown in Fig. 8, Ouchi also discloses a sensing section which includes an electrode 41, a piezoelectric film 43 and an electrode 45.

However, as noted by the Examiner on page 5 of the Office Action, Ouchi does not disclose an auxiliary weight unit, as required by amended independent claims 1 and 7. In this regard, the Examiner notes that Takahashi, Ganter and Staudte all disclose tuning fork resonators which include additional weight units, and asserts that it would have been obvious to one of ordinary skill in the art to combine the additional weight unit of Takahashi, Ganter or Staudte with that of Ouchi.

Takahashi discloses a tuning fork which includes masses deposited at various locations of the tuning fork, as shown in Figs. 15 and 18-20. However, Takahashi does not disclose an auxiliary weight unit which includes *a first electrode provided on the first vibrating arm, a piezoelectric layer provided on the first electrode, and a second electrode provided on the piezoelectric layer*, as required by independent claims 1 and 7. Rather, Takahashi only discloses that the tuning fork includes masses which are deposited on the arms, and does not disclose that the masses include a first electrode provided on the first vibrating arm, a piezoelectric layer provided on the first electrode, and a second electrode provided on the piezoelectric layer, as required by independent claims 1 and 7.

Further, Takahashi also does not disclose an auxiliary weight unit provided on the first vibrating arm and *between the drive unit and the second end of the first vibrating arm, with the auxiliary weight unit being separated from the drive unit and the detection unit*, as required by independent claims 1 and 7. Rather, Takahashi discloses that the masses are deposited on parts of the electrodes (Fig. 18, column 9, lines 1-13) and therefore teaches away from an auxiliary weight unit being separated from the drive unit and the detection unit, as required by independent claims 1 and 7.

Therefore, it is respectfully submitted that the invention of independent claims 1 and 7

would not have been obvious in view of Ouchi as modified by Takahashi, because the combination of the Ouchi and Takahashi references does not disclose an auxiliary weight unit which includes *a first electrode provided on the first vibrating arm, a piezoelectric layer provided on the first electrode, and a second electrode provided on the piezoelectric layer*, as required by independent claims 1 and 7, and because Takahashi teaches away from an auxiliary weight unit being separated from the drive unit and the detection unit by disclosing masses which are deposited on parts of the electrodes.

Ganter discloses a tuning fork which includes additional masses 22 and 23 (Fig. 1a) or additional masses 58 and 59 (Fig. 6a) at ends of the tuning fork. However, Ganter does not disclose an auxiliary weight unit which includes *a first electrode provided on the first vibrating arm, a piezoelectric layer provided on the first electrode, and a second electrode provided on the piezoelectric layer*, as required by independent claims 1 and 7. Rather, Ganter only discloses that the tuning fork includes additional masses, and does not disclose that the masses include a first electrode provided on the first vibrating arm, a piezoelectric layer provided on the first electrode, and a second electrode provided on the piezoelectric layer, as required by independent claims 1 and 7.

Therefore, it is respectfully submitted that the invention of independent claims 1 and 7 would not have been obvious in view of Ouchi as modified by Ganter, because the combination of the Ouchi and Ganter references does not disclose an auxiliary weight unit which includes *a first electrode provided on the first vibrating arm, a piezoelectric layer provided on the first electrode, and a second electrode provided on the piezoelectric layer*, as required by independent claims 1 and 7.

Staudte discloses a tuning fork resonator which, as shown in Fig. 4, includes metal film weights 50a and 50b at ends of the arms of the tuning fork. However, Staudte does not disclose an auxiliary weight unit which includes *a first electrode provided on the first vibrating arm, a piezoelectric layer provided on the first electrode, and a second electrode provided on the piezoelectric layer*, as required by independent claims 1 and 7. Rather, Staudte only discloses that each metal film weight is 1 micron thick and is made of deposited metal, but does not disclose that the metal film weights include a first electrode provided on the first vibrating arm, a

piezoelectric layer provided on the first electrode, and a second electrode provided on the piezoelectric layer, as required by independent claims 1 and 7.

Therefore, it is respectfully submitted that the invention of independent claims 1 and 7 would not have been obvious in view of Ouchi as modified by Staudte, because the combination of the Ouchi and Staudte references does not disclose an auxiliary weight unit which includes *a first electrode provided on the first vibrating arm, a piezoelectric layer provided on the first electrode, and a second electrode provided on the piezoelectric layer*, as required by independent claims 1 and 7.

Therefore, for the reasons presented above, it is believed apparent that the present invention as recited in independent claims 1 and 7 is not disclosed or suggested by the Ouchi reference, the Takahashi reference, the Ganter reference and the Staudte reference taken either individually or in combination. It is also noted that none of the Mori, Tomikawa, Hasegawa and Yachi references cures the defects of the prior art as described above. Accordingly, a person having ordinary skill in the art would clearly not have modified the Ouchi reference in view of the Takahashi reference, the Ganter reference or the Staudte reference in such a manner as to result in or otherwise render obvious the present invention of independent claims 1 and 7.

Therefore, it is respectfully submitted that independent claims 1 and 7, as well as claims 2-4, 6 and 8-12 which depend therefrom, are clearly allowable over the prior art of record.

In addition, the Examiner's attention is directed to the dependent claims which further define the present invention over the prior art. For example, new dependent claims 10 and 12 recite that the first electrode, the piezoelectric layer and the second electrode of the auxiliary weight unit have a same structure as that of the first electrode, the piezoelectric layer and the second electrode of the drive unit, respectively. New dependent claim 11 recites that the first electrode, the piezoelectric layer and the second electrode of the auxiliary weight unit have a same structure as that of the first electrode, the piezoelectric layer and the second electrode of the detection unit, respectively. It is respectfully submitted that the applied prior art does not disclose the limitations of new dependent claims 10-12.

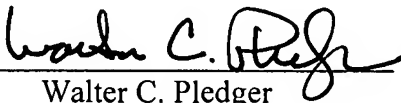
In view of the foregoing amendments and remarks, it is respectfully submitted that the present application is clearly in condition for allowance. An early notice to that effect is

respectfully solicited.

If, after reviewing this Amendment, the Examiner feels there are any issues remaining which must be resolved before the application can be passed to issue, the Examiner is respectfully requested to contact the undersigned by telephone in order to resolve such issues.

Respectfully submitted,

Satoshi OHUCHI et al.

By: 

Walter C. Pledger
Registration No. 55,540
Attorney for Applicants

WCP/lkd
Washington, D.C. 20006-1021
Telephone (202) 721-8200
Facsimile (202) 721-8250
October 5, 2007